Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

INTEGRATED ADAPTIVE GUIDANCE AND CONTROL TECHNOLOGY TESTING SUCCESSFUL

The Air Vehicles Directorate developed a reusable launch vehicle (RLV) automatic landing system that identifies and compensates for a variety of in-flight control surface failures. Its use will increase RLV system safety and reliability.

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Accomplishment

Directorate engineers, in conjunction with Barron Associates, Boeing, and General Dynamics, completed 3 months of flight testing on an automatic landing system that compensates for control system failures in RLVs like the X-40A space maneuvering vehicle (SMV). Directorate in-house researchers and contractors jointly developed the integrated adaptive guidance and control (IAG&C) technology used in the autonomous landing system. During testing, the total in-flight simulator (TIFS) replicated X-40A flight characteristics for 64 evaluations covering approximately 20 different failure situations. Engineers evaluated IAG&C's ability to compensate for single or multiple failures including various combinations of locked control surfaces.

In most evaluations, TIFS "landed" on virtual runways that were actually located 20 to 1,000 ft above ground. However, during four tests, TIFS made exceptionally smooth landings on an actual runway. Overall, IAG&C successfully handled a significant number of failure scenarios.

Background

Replacing conventional space access vehicles with unmanned RLVs will greatly reduce the cost of entering earth's orbit. Before RLVs can be widely used, they will need to be safer and more reliable. To achieve this goal, future RLVs will use autonomous control systems like IAG&C to respond the way a human pilot would to failures, damage, or changing conditions.

The TIFS is a Convair NC-131H aircraft with a research cockpit grafted onto its nose. Onboard computers run simulation models that give the Convair handling characteristics of the aircraft being tested (the X-40A). The X-40A is a small version of the X-37 SMV prototype, the current candidate for the first SMV platform. The X-40A is a less expensive, lower risk way to test X-37 concepts.

Air Vehicles
Emerging Technologies

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-VA-11)